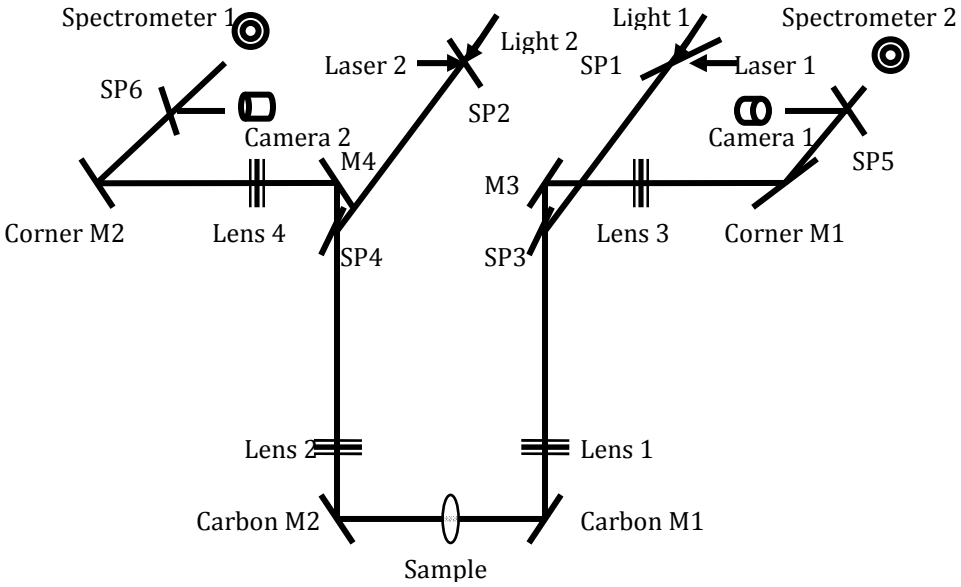
Modified @ Aug. 13, 2010

Laser heating alignment procedure



The goal is align the brightest ruby laser beam to the center of every optics center, and use it as reference to align the system perpendicular/parallel to the table.

1. **Get pinhole on x-ray spot**.
   If x-ray beam is up, scan pinhole to center the pinhole with x-ray.
   If x-ray is down,
   1) Put on LaB6 and bring it to its original position. One can adjust optics to find LaB6 (by its texture or by the diamond indentation on the gasket) on camera.
   2) Mark LaB6 center on screen.
   3) (without changing any optics) Put Ta pinhole on same spot on screen, by backlighting the hole with fiber optic light and following path of the transmitted light to the camera, then moving Huber stage (usually sample x, y, z) appropriately.

2. Roughly align the downstream/upstream ruby laser parallel to the top table by adjusting the laser source stage and/or SP1/Sp2. Tune the laser beam to hit the center of the SP1/SP2 by up/down and/or side-to-side translating the laser beam source stage. Make the laser beam hit the center of the SP3/SP4 by translating SP1/Sp2 side-to-side and up/down the SP3/SP4.
3. Take out the objective lens to align the laser beam perpendicular to the tables and coincidence with x-ray beam.

3.1 to align the laser beam perpendicular to the bottom tables. Take out the objective lens, put a mirror on the rail of the LHDAC holder. Align the downward laser beam to overlap with the reflected laser beam by tilt/tip the SP3/SP4 .

3.2 to align the laser beam coincidence with x-ray beam. Drive off the downstram heat, align the upstream laser heat go through the LHDAC gasket center and hit the x-ray beamstop by tilt/tip the Carbon mirror.

Do the same way with the downstream laser except align the downstream laser beam go through the gasket center and go through the x-ray pinhole (Jason suggest to overlap at the SP3 table hole)

3.3 get the laser image onto camera, and put back the objective lens to make sure image without moving on the camera before and after put on objective lens. If necessary, translate and/or tilt/tip the objective lens

Now the laser beam should go through the pinhole from both side and coupled on the pinhole. If slight off, adjust SP1/Sp2 and iterate the above steps without taking out the objective lens.

4. Remove image lens and align ruby laser parallel to the top table and go through the center of the spectrometer. To do this, separately align the laser path before the corner mirror and after corner mirror. Align the laser beam parallel to the top table before corner mirror by adjust the M3/M4 . Align the laser beam parallel to the top table after corner mirror by adjusting the corner mirror. Put back the image lens and make sure image on the camera without moving before and after put on image lens lens by translating and/or tilt/tip the image lens.
5. Align the ruby laser go through the center of SP5/Sp6, adjust SP5/SP6 and camera to make the image on the center of the monitor.
6. Align the user DAC. As long as the user DAC aligned onto x-ray beam and rotation axis, user's DAC should be on the laser beam as well. If necessary, adjust the objective lens focus due to diamond reflections, and tilt/tip SP1/Sp2 to **slightly** adjust the laser beam.
7. Temperature measurement. Open spectrometer slit size to make and change the spectrometer grating to "0" image mode. Adjust the image to the center of the spectrometer slit by translate the corner mirror. Close the slit size to 30um (??) and change the spectrometer grating to 700 to collect a spectrum.

Benchmark of Laser heating system alignment

1. Align the both side laser coupling
2. Before complete the alignment, make sure telecentering by moving objective lens and image lens
3. Before put on user sample, laser heating a piece of foil to check if the spectrum on the WinSpec32 is straight

4. After collect a spectrum on WinSpec32, calculate the temperature and check if the hottest row number on WinSpec32 match the hottest row number from temperature profile
5. Calculate the Plank fitting and Wien approximation, and check if their difference fall into less than 5%.
6. Collect a series of ambient pressure standard foil melting measurement, plot temperature vs laser power